

# MCDOT TRAFFIC IMPACT PROCEDURES



## INTRODUCTION

One of Maricopa County's key objectives is to operate and maintain a safe and efficient roadway system. The review and management of development-generated traffic is an integral part of operating and maintaining a safe and efficient roadway system. The Traffic Impact Procedures as outlined in this document have been established to meet this objective. The Traffic Impact Procedures establish a range of traffic impact study categories based on the characteristics of the development and the estimated peak hour traffic volumes. The procedures also outline the analysis approach and methods.

A Traffic Impact Study, TIS, identifies existing traffic volumes and conditions, development traffic volumes and conditions and their combined impacts on the existing and future roadway system. The TIS is a useful tool for early identification of potential traffic problems and can play an important part in the success of a development. When insufficient attention is given to the assessment of traffic impacts, the following problems may result:

- on-site congestion and/or congestion on adjacent roadways
- inadequate access capacity
- high accident experience
- limited flexibility to modify the development to eliminate problems or adjust to changed conditions

These problems can negatively affect the success of a development and can damage the marketability and return on investment of the development. The performance of a TIS provides an opportunity for the County and the developer to share information and jointly address traffic related problems. It provides a means of balancing development needs with the functional integrity of the roadways that serve both the development and the region.

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The need for a Traffic Impact Study should be assessed as early as possible in the development process when there is maximum flexibility for eliminating traffic-related problems. Preparation of a TIS, at this stage in the development process, is also recommended in Chapter 2 “Site Planning” of the Institute of Transportation Engineers publication ‘Transportation and Land Development’

The procedures contained herein are provided to:

- assist developers through the approval process by outlining the requirements and level of detail of traffic analysis that will be required of them during the approval process
- standardize the types and details of analysis required in the assessment of traffic impacts for developments with similar levels of size and intensity
- ensure consistency in the preparation and review of a TIS through standardization of the reports

A TIS will be required of all developments or additions to existing developments generating 100 or more trips during the morning or afternoon peak hour. A TIS may also be required for developments generating lower peak hour volumes where; current traffic problems or concerns exist, the public may perceive an adverse impact on the adjacent neighborhoods or other areas, the proximity of site drives to other drives or intersections could create traffic concerns, or other specific problems or concerns may be aggravated by the proposed development. Should such conditions arise the County Traffic Engineer will evaluate the need for the study based on technical merit.

Figure 1 is intended to show the development process that may require a TIS. Developments processed under Development Master Plans, DMP’s, Comprehensive Plan Amendments, CPA’s, or as rezoning cases will not be required to provide a revised TIS during the subdivision or building permit processes unless:

- the level of development changes significantly to warrant a new study
- the adjacent roadway system changes significantly to warrant a new study
- detailed information for commercial access analysis was not available during the initial development process

The need for an initial TIS or a revised TIS will be determined by the County Traffic Engineer in accordance with the intent of these guidelines.

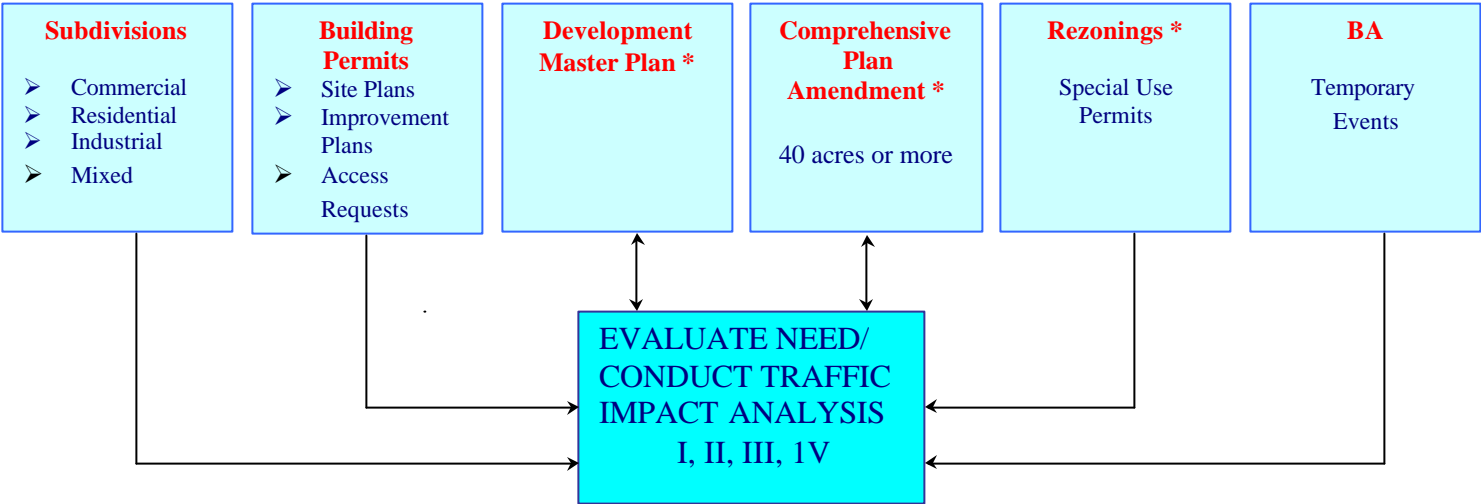
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The Traffic Impact Study may be prepared by an engineering firm selected by the developer or, if requested, by an on-call consultant under contract to Maricopa County Department of Transportation, MCDOT. If the TIS is prepared by an on-call consultant under contract to MCDOT, the MCDOT Consulting Engineer will be requested to provide a cost estimate for conducting the TIS. This estimate will be presented to the developer for review. The funds for the study shall be provided by the developer to MCDOT prior to commencement of the study.

A Draft TIS will be submitted to both the developer and the County for review. Review comments are to be provided within two weeks of submittal. If it is determined that the proposed development falls within two or more governmental jurisdictions, an agreement will be made by MCDOT, the developer, and the involved agencies, and an additional two (2) weeks will be added for a maximum review period of four (4) weeks.

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TRAFFIC IMPACT ANALYSIS  
IN THE DEVELOPMENT PROCESS



\*Requires Zoning or Rezoning

FIGURE 1

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### **A. TIS Evaluation:**

A Traffic Impact Study is required for all new developments or additions to existing developments, for any of the processes shown in Figure 1, which generate 100 or more trips during the morning or afternoon peak hour of adjacent street traffic. The specific analysis requirements and level of detail are determined by the following categories:

**CATEGORY I.** Developments which generate 100 or more peak hour trips but fewer than 500 trips during the morning or afternoon peak hour. A Category I Traffic Impact Analysis may also be required for sites generating less than 100 trips during the morning or afternoon peak hour for any of the following reasons:

- a. The existence of any current traffic problems or concerns in the local area such as an offset intersection, a high number of traffic accidents, etcetera
- b. The sensitivity of the adjacent neighborhoods or other areas where the public may perceive an adverse impact
- c. The proximity of site drives to other drives or intersections
- d. Other specific problems or concerns that may be aggravated by the proposed development

Should such conditions arise the County Traffic Engineer will evaluate the need for the study based on technical merit.

**CATEGORY II** Developments which generate 500 or more peak hour trips but fewer than 1,000 trips during the morning or afternoon peak hour.

**CATEGORY III** Developments which generate 1,000 or more peak hour trips but fewer than 1,500 trips during the morning or afternoon peak hour.

**CATEGORY IV** Developments which generate more than 1,500 trips during the morning or afternoon peak hour.

The developer must first estimate the number of vehicle trips generated by the proposed development using the procedure(s) outlined in this document. For the convenience of the developer examples of various size developments which generate 100 morning or afternoon peak hour trips have been provided in Appendix A. The developer must obtain the concurrence of the County Traffic Engineer or his designated representative on the number of trips generated by the development, if TIS is required, and the Analysis

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Category. The developer may also directly request the MCDOT Traffic Engineering Staff make these determinations. Should the developer be unable to meet the approval of the County Traffic Engineer the developer may make an appeal to the Director of the Maricopa County Department of Transportation, MCDOT.

### **B. ANALYSIS APPROACH AND METHODS**

The traffic analysis approach and methods are presented below.

#### **1. STUDY AREA**

The minimum study area will be determined by project type and size in accordance with the criteria in Table 1. The study area for the proposed development includes traffic signal controlled intersections; intersections without signal control and driveways to ensure their operation and level of service are adequately assessed. The County Traffic Engineer may require expansion of the study area when the minimum study areas identified in Table 1 do not provide sufficient information to meet the intent of the Traffic Impact Study guidelines. For example, a large (Category III) development in a rural area located two miles from a freeway interchange from which most of the trips are anticipated to access the development may require an enlarged study area to include assessment of the freeway interchange.

#### **2. STUDY HORIZON YEARS**

The study horizon years will be determined by project type and size in accordance with the criteria in Table 1.

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**TABLE 1**

| Analysis Category | Development Characteristic                       | Study Horizons (a)                           | Minimum Study Area (b)  |
|-------------------|--|--|---|
| I                 | Small Development<br>100-499 peak trips          | 1. Opening Year                              | 1. Site access drives<br>2. Adjacent signal controlled intersections within ¼ mile and/or major street intersections without signal control and driveways within 500 feet |
| II                | Moderate Development<br>500-999 peak hour trips  | 1. Opening year<br>2. 5 years after opening  | 1. Site access drives<br>2. All signal controlled intersections within ½ mile and/or major street intersections without signal control and major driveways within ½ mile  |
| III               | Large Development<br>1,000-1,500 peak hour trips | 1. Opening year<br>2. 20 years after opening | 1. Site access drives<br>2. All signal controlled intersections within 1 mile and/or major street intersections without signal control and major driveways within 1 mile  |
|                   | Regional Development<br>> 1,500 peak hour trips  | 1. Opening year<br>2. 20 years after opening | 1. Site access drives<br>2. Key signal controlled intersections and major street intersections without signal control within 3 miles                                      |

- a. Assume full occupancy and build-out for single-phase developments. Multi-phase developments may require assessment of up to three (3) horizon years corresponding to key phases as directed by the County Engineer.
- b. An enlarged study area may be required when the minimum study areas identified in Table 1 do not provide sufficient information to meet the intent of the Traffic Impact Study guidelines.

### 3. ANALYSIS TIME PERIOD

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- a. Both the morning and afternoon weekday peak hours are to be analyzed. If the proposed project is expected to generate no trips or a very low number of trips during either the morning or evening peak periods the requirement to analyze one or both of these periods may be waived by the County Traffic Engineer.
- b. Where the peak traffic hour in the study area occurs during a time period other than the normal morning or afternoon peak travel periods (for example midday), or occurs on a weekend, or of the proposed project has unusual peaking characteristics, these peak hours must also be analyzed.

### **4. SEASONAL ADJUSTMENTS**

The traffic volumes for the analysis hours should be adjusted for the peak season if appropriate. Use of seasonal adjustment factors should be approved by the County Traffic Engineer. The intent is not to assess maximum peak hourly volumes, such as the day after Christmas for a retail development, but to address peak seasonal volumes. If traffic counts were collected in a retirement community in July, and the peak traffic period occurs during the winter months, the counts should be adjusted to winter months.

### **5. DATA COLLECTION REQUIREMENTS**

All data is to be collected in accordance with the latest edition of the *ITE Manual of Transportation Engineering Studies* or as directed by the County Traffic Engineer if not specifically covered in the ITE Manual.

- a. Turning movement counts shall be obtained for all existing cross-street intersections to be analyzed during the morning and afternoon peak periods. Available turning movement counts may be extrapolated a maximum of two years with concurrence of the County Traffic Engineer.
- b. The current and projected daily traffic volumes shall be presented in the report. Available daily count data may be obtained from MCDOT and extrapolated a maximum of two years with the concurrence of the County Traffic Engineer.

Where daily count data are not available, mechanical counts may be required at the County Traffic Engineer's discretion for rural highways where the closest intersection is ½ mile or further from the site.

- c. Roadway geometric information shall be obtained including roadway width, number of lanes, turning lanes, vertical grade, location of nearby driveways, and lane configuration at intersections.
- d. The location and type of traffic controls shall be identified.



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### **6. TRIP GENERATION**

- a. The latest edition of ITE's *Trip Generation* shall be used for selecting trip generation rates. The guidelines contained in the *Trip Generation* shall be used to determine whether the average trip generation rate or equation should be used.
- b. Other rates may be used with the approval of the County Traffic Engineer in cases where *Trip Generation* does not include trip rates for a specific land use category, or includes only limited data, or where local trip rates have been shown to differ from the ITE rates such as in the *Retirement Community Trip Generation Study* prepared for Maricopa County Department of Transportation by JHK & Associates, March 18, 1993.

### **7. TRIP DISTRIBUTION AND ASSIGNMENT**

- a. Projected trips shall be distributed and added to the projected non-site traffic on the roadway network.
- b. Projected trips shall be distributed based upon a market area. The market area is the area surrounding the site from which the project is likely to draw a high percentage (80 percent or more) of its trips. The market area shall be established based upon a travel distance derived from travel time and travel speed. The market area will be determined with the criteria in Table 2. For development types not shown in Table 2, the market area will be determined based on the distance to similar competing developments. Peak hour speed limits shall reflect actual roadway conditions. The market area may be modified to account for similar commercial developments with concurrence of the County Traffic Engineer. The specific assumptions and data sources used in deriving trip distribution and assignment shall be documented in the report.

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**TABLE 2**

| Land Use Activity  | Factors for Determining Market Area  | Database within the Market Area   |
|--|--|---|
| Regional Shopping Center   | 1. Competing similar commercial developments<br>2. Travel time – usually a maximum of 30 minutes         | Population Distribution*<br>(sometimes weighted by projected spendable income in the proposed center)         |
| Community Shopping Center  | 1. Competing similar commercial developments<br>2. Travel time – usually a maximum of 20 minutes         | Population distribution*<br>(sometimes weighted by projected spendable income in the proposed center)         |
| Industrial park and office park  | Travel time – usually a maximum of 30 minutes or a distance of 10-15 miles is assumed                    | Population distribution*  |
| Stadium  | Travel time – usually a maximum of 40 minutes or more dependent on the size and character of the stadium | Population distribution*<br>(sometimes weighted by travel time, i.e. the longer travel time is weighted less) |
| Residential  | Travel time – usually a maximum of 30 minutes or a distance of 10 miles is assumed                       | Employment- opportunity distribution*   |
| Source: Institute of Transportation Engineers. <u>Transportation and Land Development</u> Washington D.C. 1987 |  |   |
| * MAG Population Projections should be used for the design year(s)   |  |   |

### 8. CAPACITY ANALYSIS

- a. Level of service shall be computed for signal controlled and non-signal controlled intersections as identified in the Study Area in Table 1, in accordance with the latest edition of the *Highway Capacity Manual*.
- b. For signal controlled intersections, operational analyses shall be performed for time horizons up to 5 years. Operational analyses shall also be performed for street sizing. The planning method will be acceptable for time horizons beyond 5 years and is also acceptable for Traffic Impact Studies prepared at the Development Master Plan level, unless used for street sizing.

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- c. For urban roadways, and rural highways where signal controlled intersections are at or less than 1 mile apart, the capacity of the roadway is generally dominated by the capacity of the adjacent signal controlled intersections. Roadway levels of service need not be computed for these facilities.
- d. For rural highways where the signal controlled intersections are more than 1 mile apart, the level of service on the highway shall be estimated in accordance with the latest edition of the *Highway Capacity Manual*.

### 9. TRAFFIC SIGNAL NEEDS

- a. A traffic signal needs study shall be conducted for all arterial/arterial, arterial/collector and collector/collector intersections within the Study Area for the opening year. If the warrants are not met for the opening year, they should be evaluated for a 5-year horizon for Categories II, III and IV.
- b. Traffic Signal needs studies shall be conducted per ADOT PGP-4C-2-X, "Traffic Signal Needs Study."

### 10. QUEUING ANALYSIS

- a. A queuing analysis shall be conducted for all turn lanes under stop or signal control within the study area. Various methods for computing queue lengths may be used. Examples of approximate methods for estimating queue lengths for signal controlled and non-signal controlled intersections are given below.

For **signal controlled intersections**, find the number of vehicles arriving at the intersection. (ADOT Traffic Impact Analysis for Proposed Development, p 25).

$$\frac{\text{Vehicles/cycle}}{(\text{vehicles/hour})/(\text{cycles/hour})} \quad (\text{for random arrivals}) = 2 \times$$

$$\text{Storage length} = \text{vehicles/cycles} \times 25 \text{ feet}$$

Example: Find the storage length required for 150 vph turning left if the signal cycle is 90 seconds.

$$\text{Vehicles/cycle} = 2 \times (150 \text{ veh/hr})(1 \text{ cycle/90 sec})/(3600 \text{ sec/hr}) = 7.5 \text{ veh/cycle}$$

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$$\text{Storage length} = 7.5 \text{ veh/cycle} \times 25 \text{ feet} = 187.5 \text{ feet}$$

USE 200 feet

For **non-signal controlled intersections**, find the number of vehicles per average 2 minute period (AASHTO Green Book, p 829)

$$\text{Vehicles/2 min period} = (\text{vehicles/hour}) / (30 \text{ periods/hour})$$

$$\text{Storage length} = \text{vehicles/2 min period} \times 25 \text{ feet}$$

Example: Find the storage length required for 150 vehicles turning left at a non-signal controlled intersection.

$$\text{Vehicles/2 min period} = (150 \text{ veh/hr}) / (30 \text{ periods/hr}) = 5 \text{ vehicles}$$

$$\text{Storage length} = 5 \text{ veh} \times 25 \text{ feet} = 125 \text{ feet}$$

USE 125 feet

### 11. SPEED CONSIDERATIONS

- a. Vehicle speed is used to estimate safe stopping and cross-corner sight distances. The design speeds set forth in Procedure 5.5 “Geometric Design Standards – Design Speeds” of the *Maricopa County Roadway Design Manual* should be used to estimate safe stopping and cross-corner sight distances for roadways.

Safe stopping and cross-corner sight distances shall be evaluated using procedures 6.1 “General Controls” and 5.15 “Stopping Sight Distance” of the *Maricopa County Roadway Design Manual*.

### 12. IMPROVEMENT ANALYSIS

The roadways and intersections within the study area shall be analyzed with and without the proposed development to identify any projected impacts in regard to level of service and safety.

- a. Where an intersection will operate at a level of service below the design objectives set forth in Procedure 2.3 “Traffic Analysis – Traffic Impact Procedures” of the *Maricopa County Department of Transportation Roadway Design Manual*, alternatives which mitigate these impacts will be evaluated and included as part of the study.

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- b. Where a highway will operate at a level of service below the design objectives set forth in Procedure 2.3 “Traffic Analysis – Traffic Impact Procedures” of the *Maricopa County Department of Transportation Roadway Design Manual*, alternatives which mitigate these impacts will be evaluated and included as part of the study.

### **13. CERTIFICATION**

- a. The Traffic Impact Analysis shall be prepared under the supervision of a Professional Engineer (Civil) registered in the State of Arizona.

## **C. STUDY AND REPORT FORMAT**

### **1. INTRODUCTION AND SUMMARY**

- a. Purpose of report and study objectives
- b. Executive Summary
  - Site location and study area
  - Development description
  - Principal findings
  - Conclusions/Recommendations

### **2. PROPOSED DEVELOPMENT (Site and Nearby)**

- a. Site location
- b. Land use and intensity
- c. Site plan (copy must be legible)
  - Access geometrics
- d. Development phasing and timing

### **3. STUDY AREA CONDITIONS**

- a. Study area
  - Area of significant traffic impact (including road segments, intersections and driveways)
  - Market area
- b. Land use
  - Existing land use
  - Anticipated future development
- c. Site accessibility
  - Existing and future area roadway system
  - Site circulation

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### **4. ANALYSIS OF EXISTING CONDITIONS**

- a. Physical characteristics
  - Roadway characteristics
  - Traffic control devices
  - Transit service
  - Pedestrian/bicycle facilities
  - Existing transportation demand management
- b. Traffic volumes
  - Daily, morning and afternoon peak periods (one hour for each peak period), and others as required
- c. Level of service
  - Morning peak hour, afternoon peak hour, and others as required
- d. Safety related deficiencies
- e. Data sources

### **5. PROJECTED TRAFFIC**

- a. Site traffic forecasting (each horizon year)
  - Trip generation
  - Mode split (if applicable)
  - Pass-by traffic (if applicable)
  - Trip distribution
  - Trip assignment
- b. Non-site traffic forecasting (each horizon year)
  - Projections of non-site traffic by Maricopa Association of Governments Association of Governments Transportation Planning Office (MAGTPO) may be used. For larger developments and study areas, a transportation planning model run may be required.
- c. Total traffic (each horizon year)

### **6. TRAFFIC AND IMPROVEMENT ANALYSIS**

- a. Site access
- b. Level of service analysis
  - Without project (including programmed improvements for each horizon year)
  - With project (including programmed improvements for each horizon year)
- c. Roadway improvements
  - Improvements by MCDOT or others to accommodate non-site traffic
  - Additional alternative improvements to accommodate site traffic
- d. Traffic safety

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- Sight distance
- Acceleration/deceleration lanes, left-turn lanes
- Adequacy of location and design of driveway access
- e. Pedestrian considerations
- f. Speed considerations
- g. Traffic control needs
- h. Traffic signal needs (base plus 5-year horizon)
- i. Transportation demand management

### **7. INTERNAL PROJECT SITE CIRCULATION (IF APPLICABLE)**

- a. Conflict points
  - Vehicle/vehicle
  - Vehicle/pedestrian
  - Sight distances
  - Building access delivery points
  - Drive-through lanes
- b. Design features
  - Widths of internal circulation roadways
  - Parking dimensions
- c. Other features
  - Fire lanes
  - Delivery truck circulation/truck docks
  - Access to waste containers

### **8. CONCLUSIONS**

### **9. RECOMMENDATIONS**

- a. Roadway improvements
  - Phasing
- b. Site access
- c. Internal site circulation
- d. Transportation demand management actions (if appropriate)
- e. Other

### **10. APPENDICES**

- a. Traffic counts
- b. Capacity analyses worksheets
- c. Traffic signal needs studies

### **11. FIGURES AND TABLES**

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The following information should be provided:

- a. Site location
- b. Site plan
- c. Existing transportation system(s)
- d. Existing and future area development  
Existing daily
- e. Existing peak hour turning volumes  
Future transportation system
- f. Estimated site traffic generation (daily and peak period)
- g. Directional distribution of site traffic (daily and peak period)
- h. Site traffic (peak period)
- i. Non-site traffic (peak period)
- j. Total future traffic (peak period)
- k. Protected levels of service including existing, horizon year non-site and total horizon year (with site development) conditions
- l. Recommended improvements

Category I Figures and Tables may be documented within the text. For Categories II, III, and IV the items should be included as separate figures and/or tables. All figures and tables must be legible.

### **APPROVALS**

- A. Submit traffic impact analysis to the County Traffic Engineer and/or Developer
- B. A two (2) week review period will be provided. If another jurisdiction is involved, an inter-jurisdictional agreement will be made between MCDOT, the developer and other agencies. The review period will be extended an additional two (2) weeks for a maximum review period of four (4) weeks.
- C. The County Traffic Engineer or designated representative shall review and approve the Traffic Impact Analysis.
- D. Should the developer be unable to meet the approval of the County Traffic Engineer, the developer may make an appeal to the Director of the Maricopa County Department of Transportation, MCDOT.



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### DESIGN STANDARD REFERENCE

- A. Design in accordance with the current Maricopa County Roadway Design Manual and other current MAG and MCDOT policies, procedures and standards.
- B. Capacity analyses in accordance with the latest edition of the *Highway Capacity Manual*.
- C. Traffic Signal needs studies in accordance with the latest edition with ADOT PGP-4C-2-X, "Traffic Signal Needs Study"
- D. Data collection in accordance with the latest edition of the ITE Manual of *Traffic Engineering Studies*
- E. Trip generation in accordance with the latest edition of the ITE publication *Trip Generation*.

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## **APPENDIX A**

### **THRESHOLDS FOR REQUIRING A TRAFFIC IMPACT STUDY**

#### **PROJECT SIZES GENERATING 100 MORNING OR AFTERNOON PEAK HOUR TRIPS**

The following table shows various development sizes, which generate 100 morning or afternoon peak hour trips. These sizes were determined using trip generation rates from the *ITE Trip Generation*, Fifth Edition. The latest edition shall be used for selecting trip generation rates.

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### THRESHOLDS FOR REQUIRING TRAFFIC IMPACT ANALYSIS PROJECT SIZES GENERATING 100 PEAK HOUR TRIPS

| Land Use                                | UNIT     | THRESHOLD      |
|---|----------|----------------|
| <b><u>RESIDENTIAL</u></b>               |          |                |
| Single Family                           | DU       | 100 DU         |
| Condominium/Townhomes                   | DU       | 175 DU         |
| Apartments                              | DU       | 150 DU         |
| Mobile Home                             | DU       | 180 DU         |
| RV Park                                 | SPACE    | 400 DU         |
| Retirement Community                    | DU       | 250 DU         |
| <b><u>COMMERCIAL</u></b>                |          |                |
| Walk-in Bank                            | 1,000 SF | 5,000 SF       |
| Drive-in Bank                           | 1,000 SF | 2,000 SF       |
| Walk-in S & L                           | 1,000 SF | 18,000 SF      |
| Drive-in S & L                          | 1,000 SF | 10,000 SF      |
| Shopping Center                         | 1,000 SF | 6,000 SF       |
| Grocery Store                           | 1,000 SF | 10,000 SF      |
| 24-Hour Convenience Store               | 1,000 SF | 1,500 SF       |
| Discount Store                          | 1,000 SF | 16,000 SF      |
| Furniture Store                         | 1,000 SF | 250,000 SF     |
| Lumber Store                            | 1,000 SF | 30,000 SF      |
| Hardware/Paint Store                    | 1,000 SF | 20,000 SF      |
| Auto Sales                              | 1,000 SF | 40,000 SF      |
| Nursery/Garden Center                   | ACRE     | 13.5 ACRES     |
| Vehicle Repair (Automobile Care Center) | 1,000 SF | 35,000 SF      |
| Bowling Alley                           | LANE     | 30 LANES       |
| Gas Station                             | PUMP     | 6 SINGLE PUMPS |
| Racquet Club                            | COURT    | 26 COURTS      |
| Health Club                             | 1,000 SF | 24,000 SF      |
| Quality Restaurant                      | 1,000 SF | 13,000 SF      |
| Sit Down High Turnover                  | 1,000 SF | 6,000 SF       |
| Fast Food (with drive-thru)             | 1,000 SF | 2,000 SF       |
| <b><u>OFFICES</u></b>                   |          |                |
| Office                                  | 1,000 SF | 43,000 SF      |
| Office Park                             | 1,000 SF | 60,000 SF      |
| Business Parks                          | 1,000 SF | 70,000 SF      |
| Research & Development                  | 1,000 SF | 100,000 SF     |
| Government Office                       | 1,000 SF | 9,000 SF       |
| Post Office                             | 1,000 SF | 10,000 SF      |